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XXXII. *Experiments to investigate the Variation of Local Heat.*

By James Six, Esq.; communicated by the Rev. Francis Wollaston, LL.B. F. R. S.

Read June 10, 1784.

BEING desirous of investigating the variation of local heat, I made the following experiments.

On the 4th of September, 1783, I placed thermometers in three different stations; one on the top of the high tower of Canterbury Cathedral, about 220 feet from the ground; another at the bottom of the same tower, at about 110 feet; and a third in my own garden*, not more than six feet from the ground. They were all carefully exposed to the open air in a shady northern aspect; the lowest was as little liable to be affected by the reflection of the sun's rays as the elevation would permit, the second still less, and the highest not at all. They continued unremoved in their several places, where I visited them daily for the space of three weeks, and minuted down the greatest degree of heat and cold that happened each day and night in their respective stations†.

* This garden is situate not far from the Cathedral, at the extremity of the buildings on the north side of the city.

† The thermometers here made use of were constructed to shew the greatest degree of heat and cold which happened in the observer's absence (described Phil. Transf. vol. LXXII. part I.), which rendered them particularly convenient on this occasion. They had hung together for some time, and seldom differed half a degree from each other.

By

By these observations it appears, see Table I. that, notwithstanding some irregularities, the heat of the days at the lowest station always exceeded that at the middle, and still more the heat at the upper station. As in many instances the higher regions of the atmosphere have been found to be colder than the lower, and the thermometer in the garden was more liable to be heated by the reflection of the sun's rays from the earth than the upper ones, a difference of this kind might have been expected. But I was greatly surprised to find the cold of the night at the lowest, not only equal to, but, very frequently, exceeding the cold at the higher stations. As I wished to know, whether these variations would continue the same in the winter, when the weather was colder; and whether a thermometer, placed at some distance from the city, having an elevation equal to that on the top of the Cathedral tower, would agree with it; on the 19th of December, 1783, I disposed the three thermometers in the following manner: one in my garden; one on the top of the high tower, as before; and the third on the top of St. Thomas's Hill, about a mile distant from the city, where, at fifteen feet from the ground, it was nearly level with that on the Cathedral tower. Table II. contains the observations that were then made*. The weather at this time proving cold, favoured the experiment; and I now found the several thermometers nearly agreeing with each other in the day-time: but in the night, the cold at the lower station exceeded the cold at the higher ones rather more than it did in the month of September, when the weather was warmer.

* The few omissions in this Table were occasioned by the severity of the cold preventing my attending at a proper time the thermometers, which were at a considerable distance from each other.

At the time of taking these thermometrical observations, I likewise noted the different dispositions of the atmosphere in other respects: such as the pressure, moisture, and dryness of the air; force and direction of the winds; quantity of rain; whether the appearances of the sky were clear or cloudy, &c. as I apprehended the local variation of the thermometers might, in a certain degree, correspond with some particular change in the state of the atmosphere.

The event answered my expectation in a singular manner in respect to the nocturnal variation; for it generally happened, that when the sky was dark and cloudy, whatever was the condition of the atmosphere with relation to the other particulars above enumerated, the thermometers agreed pretty nearly with each other; but, on the contrary, whenever the sky became clear, the cold of the night at the lowest station in the garden constantly exceeded the cold at the top of the Cathedral tower, where the instrument was placed 220 feet from the ground, entirely exposed to the open air, wind, dews, and rain, in a shady northern aspect.

The local variations in the day-time seemed to be regulated by the general degree of heat only, without being affected by any other particular disposition of the atmosphere, or the clearness or cloudiness of the sky, as the nocturnal variations were. In the month of September, when the glasses rose from 60° to 70° , the heat at the lower station constantly exceeded the heat at the upper station; and in some measure proportionally, as the weather was hotter*. In December and January, when

* As the heat at the lower station exceeded the heat at the upper ones, when the weather was hot; and equally so, whenever the sky was cloudy, as well as when it was clear; it appears, that the glass at the lower station was not materially affected by the reflection of the sun's rays from the earth, as at first I apprehended it would be.

from below 30° they seldom rose to 40° , the local variation in the day-time nearly ceased, or was found in very small degrees inclining sometimes one way, sometimes the other.

That the clearness of the sky should contribute to the coolness of the air in the night, is not at all surprising; but that, whenever the sky becomes clear, the cold should seem to arise from the earth, and be found in the greatest degree, as long as it continues clear, in the lowest situation, seems a little extraordinary: this, however, appeared to be the case, both in the warmer as well as in the colder weather, during the whole time these observations were taken, and remarkably so on the following days. On the first of January the weather was cold, the sky cloudy, the glasses in the night were at 20° , and in the day at 34° : the wind which had been at S.E. the day before, changed in the evening to S. and brought on a thaw. On the second of January clouds and misty rain darkened the sky all day; the wind blew briskly at S.W.; the glasses in the night were at $32^{\circ}\frac{1}{2}$, in the day at 40° . On the third of January the clouds and rain continued, the weather growing still warmer; wind at S.W. by S.; the glasses in the night were at 36° , in the day at $45^{\circ}\frac{1}{2}$. These three days the weather gradually became warmer; and, while the sky remained darkened by clouds, all the glasses in their several stations nearly agreed with each other. About noon, on the third of January, the sky becoming clear, the air grew cooler; and going into my garden, about eight o'clock in the evening, I perceived the surface of the ground, which had been wet by the rain in the forenoon, began to be frozen. Looking immediately at the thermometer, I saw the mercury at $33^{\circ}\frac{1}{2}$; and observing a piece of wet linen hanging near the glass, not five feet from the ground, I took it into my hand, and found it not in the least frozen; by which it appeared, that

that the degree of cold which had frozen the surface of the ground, had not then ascended to the glass, nor to the linen, and consequently had not been communicated to the air five or six feet above the earth. The next day I found, as I expected, a considerable local variation; the index for the cold of the night in the garden being at 32° , that on the hill being at $35^{\circ}\frac{1}{4}$, and that on the top of the tower at $37^{\circ}\frac{3}{4}$ *. Probably the weather did not continue clear the whole night; if it had, it is likely the degrees of cold would have been found proportionally greater at every station. On the morning of the 4th there fell a misty rain, which continued only till noon, when the sky became clear again, and continued so till the 7th; during which time the nocturnal heights of the thermometers differed considerably from each other; but on the sky's becoming cloudy, the local variation ceased.

Thermometrical observations, made under the same circumstances in respect to the season of the year, place, and situation †, may probably be liable to similar local varia-

* It is remarkable, that the thermometer on St. Thomas's hill did not vary so much from that in the garden, as that did which was on the Cathedral tower, although these two elevated glasses were within three feet of a perfect level with each other; the variations, however, as often as they happened, inclined the same way. The reason of this might probably be, that although the glass on the hill was at an equal altitude with that on the tower, in respect to the ground on which the Cathedral stands: yet the former was only 15 feet, while the latter was 220 feet from the ground.

† Situation in regard to hill or valley. The valley in which Canterbury stands is at that place about a mile in breadth, opening to the N.E.; the hills on either side do not rise very sudden, nor very high; the river Stour, divided into branches, passes through the city, and, about fourteen miles below, empties itself into the sea, which washes the coast from the NN.W. round by the E. to the S.; distant from the city at different places from six to sixteen miles.

tions : to those who make them, the result of these experiments may be of some use. If convenient opportunity offered, I should be glad, by the assistance of friends, to try the local difference of heat and cold in more distant, as well as more elevated, situations.

By experiments of this kind it may possibly in some measure be found, how far evaporations from the earth, at certain times, or vapours ascending, descending, or meeting, in different parts of the atmosphere, may increase or diminish the heat of the air in those places : or whether different degrees of heat and cold (subject however to change) may not be found in different strata of air, or vapour, floating in different parts of the atmosphere ; or in what degree and proportion, the cold increases at different altitudes and in different seasons of the year : whether the cold, which is known to be very intense in the summer time on the tops of high mountains, receives a proportional increase, or be not less subject to variety by the return of winter and summer, night and day, than what we experience in the plains below.

March 10, 1784.

JAMES SIX.

Mr. SIX's Experiments to investigate the Variation of Local Heat.

T A B L E I.

The greatest daily variation of heat and cold in the atmosphere, from the 4th to the 17th 1783, taken from three different stations, and compared together. One thermometer in Canterbury, 220 feet from the ground; another at the bottom of the same tower; and a third in a garden, about six feet from the ground. N. B. The nocturnal degrees of the night immediately preceding the day to the date of which they are placed.

	Greatest degree of cold in the night.					Greatest degree of heat in the day.					
	Thermometer in the garden.	Thermometer at the bottom of the tower.	Thermometer on the top of the tower.	Difference of garden from bottom of tower.	Difference of garden from top of tower.	Thermometer in the garden.	Thermometer at the bottom of the tower.	Thermometer on the top of the tower.	Difference of garden from bottom of tower.	Difference of garden from top of tower.	
Sept. 4	50 $\frac{1}{2}$	—	51	—	-0 $\frac{1}{2}$	66	61	61	+5	+5	{ Morning still and in the forenoon in the afternoon
5	48	47 $\frac{1}{4}$	47 $\frac{1}{2}$	+0 $\frac{3}{4}$	+0 $\frac{1}{2}$	62 $\frac{1}{2}$	61 $\frac{1}{2}$	61 $\frac{1}{2}$	+1	+1	{ Morning cloudy; afternoon; wind 29.3.
6	48 $\frac{1}{2}$	50	50 $\frac{1}{2}$	-1 $\frac{1}{2}$	-2	66 $\frac{1}{2}$	65 $\frac{1}{4}$	64 $\frac{1}{2}$	+1 $\frac{3}{4}$	+2	{ Morning rained a S.W. most part of
7	48	49 $\frac{1}{2}$	49 $\frac{1}{2}$	-1 $\frac{1}{2}$	-1 $\frac{1}{2}$	63 $\frac{1}{2}$	62 $\frac{1}{2}$	63	+1	+0 $\frac{1}{2}$	{ Morning clear; day; wind very
8	50	51	51	-1	-1	66	62 $\frac{1}{2}$	62	+3 $\frac{1}{2}$	+4	{ Sometimes clear, very high at W.;
9	55 $\frac{1}{2}$	55 $\frac{1}{2}$	55 $\frac{1}{2}$	—	—	65	63	62 $\frac{1}{2}$	+2	+2 $\frac{1}{2}$	{ Morning close and wind brisk at S.W.
10	45	47	47 $\frac{1}{2}$	2	-2 $\frac{1}{2}$	63 $\frac{3}{4}$	59 $\frac{3}{4}$	59 $\frac{3}{4}$	+4	+4	{ Morning and great wind high at S. 29.6.
11	42	45	45 $\frac{1}{2}$	-3	-3 $\frac{1}{2}$	63 $\frac{1}{2}$	62	60 $\frac{1}{2}$	+1 $\frac{1}{2}$	+3	{ Morning clear; wind at S.; even
12	52 $\frac{1}{2}$	53 $\frac{1}{2}$	54	-1	-1 $\frac{1}{2}$	69	66 $\frac{1}{2}$	65	+2 $\frac{1}{2}$	+4	{ Morning cloudy; still and clear; h
13	45	48	48 $\frac{1}{2}$	-3	-3 $\frac{1}{2}$	65	62	62	+3	+3	{ Morning clear; afternoon; wind
14	57 $\frac{1}{2}$	57	57	+0 $\frac{1}{2}$	+0 $\frac{1}{2}$	68 $\frac{1}{2}$	66 $\frac{1}{2}$	64 $\frac{1}{2}$	+2	+4	{ Morning cloudy; at S.W.; misty 29.8.
15	57	57	58	—	-1	70	68 $\frac{1}{2}$	66	+1 $\frac{1}{2}$	+4	{ Morning cloudy; the evening char
16	52 $\frac{1}{2}$	53	52 $\frac{1}{2}$	-0 $\frac{1}{2}$	—	65 $\frac{1}{2}$	62 $\frac{1}{2}$	61	+3	+4 $\frac{1}{2}$	{ Morning hazy; wind at N.E.;
17	51 $\frac{1}{2}$	51 $\frac{1}{2}$	51	—	+0 $\frac{1}{2}$	62 $\frac{1}{2}$	61	60 $\frac{1}{2}$	+1 $\frac{1}{2}$	+2	{ Dull and hazy breeze of wind

T A B L E I.

variation of heat and cold in the atmosphere, from the 4th to the 24th of September, at three different stations, and compared together. One thermometer placed on a tower, 220 feet from the ground; another at the bottom of the same tower, 110; and a third about six feet from the ground. N. B. The nocturnal degrees of cold belong to the preceding the day to the date of which they are placed.

Cold in the night.			Greatest degree of heat in the day.					
Tower.	Difference of garden from bottom of tower.	Difference of garden from top of tower.	Thermometer in the garden.	Thermometer at the bottom of the tower.	Thermometer on the top of the tower.	Difference of garden from bottom of tower.	Difference of garden from top of tower.	
	— ^o	— ^o $\frac{1}{2}$	66 ^o	61 ^o	61 ^o	+5 ^a	+5 ^o	{ Morning still and foggy; wind began to blow in the forenoon at S.W.; clouds and rain in the afternoon and night; bar. 29.3.
	+0 $\frac{3}{4}$	+0 $\frac{1}{2}$	62 $\frac{1}{2}$	61 $\frac{1}{2}$	61 $\frac{1}{2}$	+1	+1	{ Morning cloudy; heavy rain; clear in the afternoon; wind high at W.N.W.; bar. 29.3.
	—1 $\frac{1}{2}$	—2	66 $\frac{1}{2}$	65 $\frac{1}{4}$	64 $\frac{1}{2}$	+1 $\frac{1}{4}$	+2	{ Morning rained a little; wind very high at S.W. most part of the day; bar. 29.5.
	—1 $\frac{1}{2}$	—1 $\frac{1}{2}$	63 $\frac{1}{2}$	62 $\frac{1}{2}$	63	+1	+0 $\frac{1}{2}$	{ Morning clear; continued so most part of the day; wind very high at W; bar. 29.8.
	—1	—1	66	62 $\frac{1}{2}$	62	+3 $\frac{1}{2}$	+4	{ Sometimes clear, sometimes cloudy; wind very high at W.; bar. 29.9.
	—	—	65	63	62 $\frac{1}{2}$	+2	+2 $\frac{1}{2}$	{ Morning close and cloudy; clear at noon; wind brisk at S.W.; bar. 29.5.
	2	—2 $\frac{1}{2}$	63 $\frac{3}{4}$	59 $\frac{3}{4}$	59 $\frac{3}{4}$	+4	+4	{ Morning and great part of the day clear; wind high at S.W.; evening clear; bar. 29.6.
	—3	—3 $\frac{1}{2}$	63 $\frac{1}{2}$	62	60 $\frac{1}{2}$	+1 $\frac{1}{2}$	+3	{ Morning clear; cloudy about noon; brisk wind at S.; evening still; bar. 29.8.
	—1	—1 $\frac{1}{2}$	69	66 $\frac{1}{2}$	65	+2 $\frac{1}{2}$	+4	{ Morning cloudy; wind high at S.; evening still and clear; bar. 29.4.
	—3	—3 $\frac{1}{2}$	65	62	62	+3	+3	{ Morning clear; a little rain at noon; cloudy afternoon; wind brisk at S.; bar. 29.0.
	+0 $\frac{1}{2}$	+0 $\frac{1}{2}$	68 $\frac{1}{2}$	66 $\frac{1}{2}$	64 $\frac{1}{2}$	+2	+4	{ Morning cloudy; moist warm air; wind brisk at S.W.; misty rain; cloudy evening; bar. 29.8.
	—	—1	70	68 $\frac{1}{2}$	66	+1 $\frac{1}{2}$	+4	{ Morning cloudy; wind moderate S.W.; in the evening changed to N.; bar. 29.5.
	—0 $\frac{1}{2}$	—	65 $\frac{1}{2}$	62 $\frac{1}{2}$	61	+3	+4 $\frac{1}{2}$	{ Morning hazy; thin clouds all day; little wind at N.E.; close and warm; bar. 29.8.
	—	+0 $\frac{1}{2}$	62 $\frac{1}{2}$	61	60 $\frac{1}{2}$	+1 $\frac{1}{2}$	+2	{ Dull and hazy most part of the day; little breeze of wind at N.E.; bar. 29.1.

Sept.	4	50 $\frac{1}{2}$	—	51	—	-0 $\frac{1}{2}$	66	61	61	+5	+5	{ Morning still and in the forenoon in the afternoon
	5	48	47 $\frac{1}{4}$	47 $\frac{1}{2}$	+0 $\frac{3}{4}$	+0 $\frac{1}{2}$	62 $\frac{1}{2}$	61 $\frac{1}{2}$	61 $\frac{1}{2}$	+1	+1	{ Morning cloudy; afternoon; wind 29.3.
	6	48 $\frac{1}{2}$	50	50 $\frac{1}{2}$	-1 $\frac{1}{2}$	-2	66 $\frac{1}{2}$	65 $\frac{1}{4}$	64 $\frac{1}{2}$	+1 $\frac{3}{4}$	+2	{ Morning rained a S.W. most part of
	7	48	49 $\frac{1}{2}$	49 $\frac{1}{2}$	-1 $\frac{1}{2}$	-1 $\frac{1}{2}$	63 $\frac{1}{2}$	62 $\frac{1}{2}$	63	+1	+0 $\frac{1}{2}$	{ Morning clear; c day; wind very l
	8	50	51	51	-1	-1	66	62 $\frac{1}{2}$	62	+3 $\frac{1}{2}$	+4	{ Sometimes clear, very high at W.;
	9	55 $\frac{1}{2}$	55 $\frac{1}{2}$	55 $\frac{1}{2}$	—	—	65	63	62 $\frac{1}{2}$	+2	+2 $\frac{1}{2}$	{ Morning close an wind brisk at S.W.
	10	45	47	47 $\frac{1}{2}$	2	-2 $\frac{1}{2}$	63 $\frac{3}{4}$	59 $\frac{3}{4}$	59 $\frac{3}{4}$	+4	+4	{ Morning and gre wind high at S 29.6.
	11	42	45	45 $\frac{1}{2}$	-3	-3 $\frac{1}{2}$	63 $\frac{1}{2}$	62	60 $\frac{1}{2}$	+1 $\frac{1}{2}$	+3	{ Morning clear; wind at S.; even
	12	52 $\frac{1}{2}$	53 $\frac{1}{2}$	54	-1	-1 $\frac{1}{2}$	69	66 $\frac{1}{2}$	65	+2 $\frac{1}{2}$	+4	{ Morning cloudy; still and clear; b
	13	45	48	48 $\frac{1}{2}$	-3	-3 $\frac{1}{2}$	65	62	62	+3	+3	{ Morning clear; a afternoon; wind
	14	57 $\frac{1}{2}$	57	57	+0 $\frac{1}{2}$	+0 $\frac{1}{2}$	68 $\frac{1}{2}$	66 $\frac{1}{2}$	64 $\frac{1}{2}$	+2	+4	{ Morning cloudy; at S.W.; misty 29.8.
	15	57	57	58	—	-1	70	68 $\frac{1}{2}$	66	+1 $\frac{1}{2}$	+4	{ Morning cloudy; the evening char
	16	52 $\frac{1}{2}$	53	52 $\frac{1}{2}$	-0 $\frac{1}{2}$	—	65 $\frac{1}{2}$	62 $\frac{1}{2}$	61	+3	+4 $\frac{1}{2}$	{ Morning hazy; t wind at N.E.; c
	17	51 $\frac{1}{2}$	51 $\frac{1}{2}$	51	—	+0 $\frac{1}{2}$	62 $\frac{1}{2}$	61	60 $\frac{1}{2}$	+1 $\frac{1}{2}$	+2	{ Dull and hazy m breeze of wind
	18	57	57	57	—	—	62 $\frac{1}{2}$	62	61	+0 $\frac{1}{2}$	+1 $\frac{1}{2}$	{ Very dull all day; 29.9.
	19	53	54 $\frac{1}{2}$	55 $\frac{1}{2}$	-1 $\frac{1}{2}$	-2 $\frac{1}{2}$	70	67 $\frac{1}{2}$	67	+2 $\frac{1}{2}$	+3	{ Morning clear; a wind S.S.E.; ba
	20	56	56	55 $\frac{1}{2}$	—	+0 $\frac{1}{2}$	64 $\frac{1}{2}$	63	61	+1 $\frac{1}{2}$	+3 $\frac{1}{2}$	{ Cloudy all day, clear at night; l
	21	44 $\frac{1}{2}$	47 $\frac{1}{2}$	48 $\frac{1}{2}$	-3	-4	63 $\frac{1}{2}$	61	60 $\frac{1}{2}$	+2 $\frac{1}{2}$	+3	{ Morning clear; w of the day; win
	22	56	57	57	-1	-1	59	58	58	+1	+1	{ Rain most part wind S.W.; bar
	23	50	49	50	+1	—	63	59 $\frac{1}{2}$	59 $\frac{1}{2}$	+3 $\frac{1}{2}$	+3 $\frac{1}{2}$	{ Morning still an the afternoon, wind S.W.; bar
	24	43 $\frac{3}{4}$	46	46	-2 $\frac{1}{4}$	-2 $\frac{1}{4}$	63	59 $\frac{3}{4}$	58 $\frac{3}{4}$	+3 $\frac{1}{4}$	+4 $\frac{1}{4}$	{ Clear all day; wi

—	—0 $\frac{1}{2}$	66	61	61	+5	+5	{ Morning still and foggy; wind began to blow in the forenoon at S.W.; clouds and rain in the afternoon and night; bar. 29.3.
+0 $\frac{3}{4}$	+0 $\frac{1}{2}$	62 $\frac{1}{2}$	61 $\frac{1}{2}$	61 $\frac{1}{2}$	+1	+1	{ Morning cloudy; heavy rain; clear in the afternoon; wind high at W.N.W.; bar. 29.3.
—1 $\frac{1}{2}$	—2	66 $\frac{1}{2}$	65 $\frac{1}{4}$	64 $\frac{1}{2}$	+1 $\frac{1}{4}$	+2	{ Morning rained a little; wind very high at S.W. most part of the day; bar. 29.5.
—1 $\frac{1}{2}$	—1 $\frac{1}{2}$	63 $\frac{1}{2}$	62 $\frac{1}{2}$	63	+1	+0 $\frac{1}{2}$	{ Morning clear; continued so most part of the day; wind very high at W; bar. 29.8.
—1	—1	66	62 $\frac{1}{2}$	62	+3 $\frac{1}{2}$	+4	{ Sometimes clear, sometimes cloudy; wind very high at W.; bar. 29.9.
—	—	65	63	62 $\frac{1}{2}$	+2	+2 $\frac{1}{2}$	{ Morning close and cloudy; clear at noon; wind brisk at S.W.; bar. 29.5.
2	—2 $\frac{1}{2}$	63 $\frac{3}{4}$	59 $\frac{3}{4}$	59 $\frac{3}{4}$	+4	+4	{ Morning and great part of the day clear; wind high at S.W.; evening clear; bar. 29.6.
—3	—3 $\frac{1}{2}$	63 $\frac{1}{2}$	62	60 $\frac{1}{2}$	+1 $\frac{1}{2}$	+3	{ Morning clear; cloudy about noon; brisk wind at S.; evening still; bar. 29.8.
—1	—1 $\frac{1}{2}$	69	66 $\frac{1}{2}$	65	+2 $\frac{1}{2}$	+4	{ Morning cloudy; wind high at S.; evening still and clear; bar. 29.4.
—3	—3 $\frac{1}{2}$	65	62	62	+3	+3	{ Morning clear; a little rain at noon; cloudy afternoon; wind brisk at S.; bar. 29.0.
+0 $\frac{1}{2}$	+0 $\frac{1}{2}$	68 $\frac{1}{2}$	66 $\frac{1}{2}$	64 $\frac{1}{2}$	+2	+4	{ Morning cloudy; moist warm air; wind brisk at S.W.; misty rain; cloudy evening; bar. 29.8.
—	—1	70	68 $\frac{1}{2}$	66	+1 $\frac{1}{2}$	+4	{ Morning cloudy; wind moderate S.W.; in the evening changed to N.; bar. 29.5.
—0 $\frac{1}{2}$	—	65 $\frac{1}{2}$	62 $\frac{1}{2}$	61	+3	+4 $\frac{1}{2}$	{ Morning hazy; thin clouds all day; little wind at N.E.; close and warm; bar. 29.8.
—	+0 $\frac{1}{2}$	62 $\frac{1}{2}$	61	60 $\frac{1}{2}$	+1 $\frac{1}{2}$	+2	{ Dull and hazy most part of the day; little breeze of wind at N.E.; bar. 30.1.
—	—	62 $\frac{1}{2}$	62	61	+0 $\frac{1}{2}$	+1 $\frac{1}{2}$	{ Very dull all day; wind brisk at N.E.; bar. 29.9.
—1 $\frac{1}{2}$	—2 $\frac{1}{2}$	70	67 $\frac{1}{2}$	67	+2 $\frac{1}{2}$	+3	{ Morning clear; a little rain in the afternoon; wind S.S.E.; bar. 29.6.
—	+0 $\frac{1}{2}$	64 $\frac{1}{2}$	63	61	+1 $\frac{1}{2}$	+3 $\frac{1}{2}$	{ Cloudy all day, with rain and wind S.W.; clear at night; bar. 29.4.
—3	—4	63 $\frac{1}{2}$	61	60 $\frac{1}{2}$	+2 $\frac{1}{2}$	+3	{ Morning clear; wind at S.W.; clear most part of the day; wind S.; bar. 29.8.
—1	—1	59	58	58	+1	+1	{ Rain most part of the day; evening hazy; wind S.W.; bar. 29.6.
+1	—	63	59 $\frac{1}{2}$	59 $\frac{1}{2}$	+3 $\frac{1}{2}$	+3 $\frac{1}{2}$	{ Morning still and misty; a little shower in the afternoon, clear all the rest of the day; wind S.W.; bar. 29.6.
—2 $\frac{1}{4}$	—2 $\frac{1}{4}$	63	59 $\frac{3}{4}$	58 $\frac{3}{4}$	+3 $\frac{1}{4}$	+4 $\frac{1}{4}$	Clear all day; wind W. and N.W.; bar. 29.8.

TABLE II.

The greatest daily variation of heat and cold in the atmosphere from the 20th of December to the 8th of January, 1784, taken from three different stations, and compared together. One thermometer placed on a tower in Canterbury, 220 feet from the ground; another on a hill, at the same level with that on the tower; a third in a garden, about six feet from the ground. The nocturnal degrees of cold belong to the night immediately preceding the day to which they are placed.

	Greatest degree of cold in the night					Greatest degree of heat in the day.					
	Thermometer in the garden.	Thermometer on the hill.	Thermometer on the tower.	Difference of garden from hill.	Difference of garden from tower.	Thermometer in the garden.	Thermometer on the hill.	Thermometer on the tower.	Difference of garden from hill.	Difference of garden from tower.	
Dec. 20	20°	25°	25½°	-5°	-5½°	39½°	37½°	39½°	+1½°	-0½°	{ Evening preceding wind brisk at W.; moist; barometer rising; little wind at N. noon; a little snow; Morning flight fog at N.W.; air moist; little snow; bar. 29.3.
21	29½°	30½°	32°	-1°	-2½°	37½°	38½°	38°	-0¾°	-0¼°	{ Morning clear on the hill; a little wind at N. noon; a little snow; Morning flight fog at N.W.; air moist; little snow; bar. 29.3.
22	22°	24½°	25½°	-2½°	-3½°	34°	34½°	36°	-0¾°	-2°	{ Morning clear on the hill; a little wind at N. noon; a little snow; Morning flight fog at N.W.; air moist; little snow; bar. 29.3.
23	31½°	31½°	32°	—	-0¼°	39½°	40½°	37½°	-0½°	+2¼°	{ Dark and cloudy all day; air moist; evening clear; bar. 29.3.
24	31½°	33°	34½°	-1¼°	-2¾°	43¾°	42°	41¼°	+1¼°	+2½°	{ Morning rainy; clear in the evening; wind S. at 6; bar. 29.3.
25	26°	27°	—	-1°	—	36°	35½°	—	+0¾°	—	{ Morning cloudy; wind towards evening S.; night clear; bar. 29.3.
26	26½°	26½°	28°	—	-1½°	33½°	34°	36°	-0½°	-2½°	{ Morning foggy; a little clear in the evening; N.E.; bar. 28.9.
27	25°	26½°	28°	-1½°	-3°	36°	34½°	35½°	+1¼°	-0½°	{ Morning clear; clear in the evening; morning N.E.; bar. 29.3.
28	30°	29°	29½°	+1°	+0½°	31½°	30°	33½°	+1¼°	-2¼°	{ Morning dark and cold; N.E.; air dry, and clear; bar. 29.3.
29	21°	21½°	22°	-0½°	-1°	24½°	24½°	—	-0¾°	—	{ Morning hazy; clear and cold and brisk at 8; bar. 29.3.
30	15½°	15°	16½°	+0½°	-1°	22°	21½°	21½°	+0½°	+0½°	{ Morning clear in the garden; below; wind very S.; bar. 29.7.
31	12½°	11½°	13°	+0½°	-0¾°	21½°	—	21½°	—	—	{ Sometimes clear, brisk at S.E.; evening wind S. very high; bar. 29.7.
Jan. 1	20°	—	20°	—	—	34°	—	33½°	—	+0½°	{ Wet mist all day; bar. 29.4.
2	32½°	32°	32½°	+0½°	—	40°	39½°	40°	+0½°	—	{ Morning thick fog all day; afternoon and evening with rain; bar. 29.4.

Mr. SIX's Experiments to investigate the Variation of Local Heat.

T A B L E II.

variation of heat and cold in the atmosphere from the 20th of December, 1783, to the 1784, taken from three different stations, and compared together. One thermometer in Canterbury, 220 feet from the ground; another on a hill, a mile distant, but on the same level with that on the tower; a third in a garden, about six feet from the ground. N. B. The observations of cold belong to the night immediately preceding the day to the date of which

Cold in the night			Greatest degree of heat in the day.					
Thermometer on the tower.	Difference of garden from hill.	Difference of garden from tower.	Thermometer in the garden.	Thermometer on the hill.	Thermometer on the tower.	Difference of garden from hill.	Difference of garden from tower.	
5 $\frac{1}{2}$	-5	-5 $\frac{1}{4}$	39 $\frac{1}{4}$	37 $\frac{1}{4}$	39 $\frac{1}{4}$	+1 $\frac{1}{2}$	-0 $\frac{1}{2}$	{ Evening preceding clear; morning clear; wind brisk at W.; cloudy at noon; air very moist; barometer at 29.9.
2	-1	-2 $\frac{1}{4}$	37 $\frac{3}{4}$	38 $\frac{1}{2}$	38	-0 $\frac{3}{4}$	-0 $\frac{1}{4}$	{ Morning clear on the hill; fog in the city; little wind at N.W.; air moist; cloudy at noon; a little snow; bar. 29.8.
5 $\frac{1}{2}$	-2 $\frac{1}{2}$	-3 $\frac{1}{2}$	34	34 $\frac{1}{4}$	36	-0 $\frac{3}{4}$	-2	{ Morning slight fog in the city; little wind at N.W.; air moist; cloudy at noon; a little snow; bar. 29.7.
2	—	-0 $\frac{1}{4}$	39 $\frac{3}{4}$	40 $\frac{1}{4}$	37 $\frac{1}{2}$	-0 $\frac{1}{2}$	+2 $\frac{1}{4}$	{ Dark and cloudy all day; wind brisk at S.W.; air moist; evening foggy; bar. 29.8.
4 $\frac{1}{2}$	-1 $\frac{1}{4}$	-2 $\frac{3}{4}$	43 $\frac{3}{4}$	42	41 $\frac{1}{4}$	+1 $\frac{3}{4}$	+2 $\frac{1}{2}$	{ Morning rainy; clear at noon; cloudy late in the evening; wind at N.; bar. 29.6.
—	-1	—	36	35 $\frac{1}{4}$	—	+0 $\frac{3}{4}$	—	{ Morning cloudy; wet mist; wind brisk at E.; towards evening rain mixed with snow; night clear; bar. 29.2.
8	—	-1 $\frac{1}{2}$	33 $\frac{1}{2}$	34	36	-0 $\frac{1}{2}$	-2 $\frac{1}{2}$	{ Morning foggy; a little snow about noon; evening clear in the zenith; little wind at N.; bar. 28.9.
8	-1 $\frac{1}{2}$	-3	36	34 $\frac{1}{4}$	35 $\frac{1}{2}$	+1 $\frac{1}{4}$	-0 $\frac{1}{2}$	{ Morning clear; cloudy at noon; little snow in the evening; moderate breeze of wind at N.E.; bar. 29.3.
9 $\frac{1}{2}$	+1	+0 $\frac{1}{2}$	31 $\frac{1}{4}$	30	33 $\frac{1}{2}$	+1 $\frac{1}{4}$	-2 $\frac{1}{4}$	{ Morning dark and cloudy; wind very brisk at N.E.; air dry, and felt very cold; bar. 29.3.
2	-0 $\frac{1}{2}$	-1	24 $\frac{1}{2}$	24 $\frac{3}{4}$	—	-0 $\frac{1}{4}$	—	{ Morning hazy; dry misty air; wind very cold and brisk at S.E. by E.; bar. 29.7.
6 $\frac{1}{2}$	+0 $\frac{1}{2}$	-1	22	21 $\frac{1}{2}$	21 $\frac{1}{2}$	+0 $\frac{1}{2}$	+0 $\frac{1}{2}$	{ Morning clear in the zenith; dry misty fog below; wind very cold and brisk at S.E.; bar. 29.7.
3	+0 $\frac{1}{2}$	-0 $\frac{3}{4}$	21 $\frac{1}{2}$	—	21 $\frac{1}{2}$	—	—	{ Sometimes clear, sometimes cloudy; wind brisk at S.E.; evening rain with snow; wind S. very high in the night; bar. 29.4.
0	—	—	34	—	33 $\frac{1}{2}$	—	+0 $\frac{1}{2}$	{ Wet mist all day; wind moderate at W.; bar. 29.4.
2 $\frac{1}{2}$	+0 $\frac{1}{2}$	—	40	39 $\frac{1}{2}$	40	+0 $\frac{1}{2}$	—	{ Morning thick fog and misty rain; wind S.E.; afternoon and evening very high at S.W. with rain; bar. 29.6.

	Therm in the	Therm on the	Therm on the	Differ garden	Differ garden	Therm in the	Therm on the	Therm on the	Differ garden	Differ garden	
Dec.											
20	20°	25°	25½°	-5°	-5½°	39½°	37½°	39½°	+1½°	-0½°	Evening preceding wind brisk at W.; moist; barometer
21	29½°	30½°	32°	-1°	-2¼°	37½°	38½°	38°	-0¾°	-0¼°	Morning clear on t little wind at N. noon; a little snow
22	22°	24½°	25½°	-2½°	-3½°	34°	34½°	36°	-0¾°	-2°	Morning slight fog at N.W.; air moist little snow; bar.
23	31½°	31½°	32°	—	-0¼°	39½°	40½°	37½°	-0½°	+2¼°	Dark and cloudy all air moist; evening
24	31½°	33°	34½°	-1¼°	-2¾°	43¾°	42°	41¼°	+1¼°	+2½°	Morning rainy; cle the evening; wind
25	26°	27°	—	-1°	—	36°	35½°	—	+0¾°	—	Morning cloudy; w towards evening night clear; bar.
26	26½°	26½°	28°	—	-1½°	33½°	34°	36°	-0½°	-2½°	Morning foggy; a evening clear in t N.; bar. 28.9.
27	25°	26½°	28°	-1½°	-3°	36°	34½°	35½°	+1¼°	-0½°	Morning clear; cle in the evening; m N.E.; bar. 29.3.
28	30°	29°	29½°	+1°	+0½°	31½°	30°	33½°	+1¼°	-2¼°	Morning dark and N.E.; air dry, an
29	21°	21½°	22°	-0½°	-1°	24½°	24½°	—	-0¾°	—	Morning hazy; d cold and brisk at S
30	15½°	15°	16½°	+0½°	-1°	22°	21½°	21½°	+0½°	+0½°	Morning clear in t below; wind very bar. 29.7.
31	12½°	11½°	13°	+0½°	-0¾°	21½°	—	21½°	—	—	Sometimes clear, brisk at S.E.; e wind S. very high
Jan.											
1	20°	—	20°	—	—	34°	—	33½°	—	+0½°	Wet mist all day; bar. 29.4.
2	32½°	32°	32½°	+0½°	—	40°	39½°	40°	+0½°	—	Morning thick fog a afternoon and eve with rain; bar. 20
3	36°	35½°	36°	+0½°	—	45½°	45°	45½°	+0½°	—	Morning rainy; wi noon; afternoon a still; wind S.W.;
4	32°	35¾°	37¾°	-3¾°	-5¾°	46½°	44¾°	45½°	+1¾°	+1°	Morning misty rain ing very clear and
5	26¾°	29¾°	31°	-3°	-4¼°	36½°	35½°	—	+1°	—	Morning very clear; ing very clear and
6	21½°	26°	27½°	-4½°	-6°	31°	30¾°	—	+0¾°	—	Morning very clea wind at S.E.; eve bar. 30.2.
7	16°	19°	20½°	-3°	-4½°	29°	27½°	27½°	+1½°	+1½°	Morning very clea evening dark and S.E.; bar. 30.0.
8	26°	25½°	25½°	+0½°	+0½°	32°	32°	31½°	—	+0½°	Morning dark and wind W.N.W.; ba



on the	Differ- garde h	Diffe- garde to	Therm in the	Therm on the	Therm on the	Differ- garde h	Differ- garde to	
5 $\frac{3}{4}$	-5	-5 $\frac{3}{4}$	39 $\frac{3}{4}$	37 $\frac{3}{4}$	39 $\frac{3}{4}$	+1 $\frac{1}{2}$	-0 $\frac{1}{2}$	{ Evening preceding clear; morning clear; wind brisk at W.; cloudy at noon; air very moist, barometer at 29.9.
2	-1	-2 $\frac{1}{4}$	37 $\frac{3}{4}$	38 $\frac{1}{2}$	38	-0 $\frac{3}{4}$	-0 $\frac{1}{4}$	{ Morning clear on the hill; fog in the city; little wind at N.W.; air moist; cloudy at noon; a little snow; bar. 29.8.
5 $\frac{1}{2}$	-2 $\frac{1}{2}$	-3 $\frac{1}{2}$	34	34 $\frac{1}{2}$	36	-0 $\frac{3}{4}$	-2	{ Morning slight fog in the city; little wind at N.W.; air moist; cloudy at noon; a little snow; bar. 29.7.
2	—	-0 $\frac{1}{4}$	39 $\frac{3}{4}$	40 $\frac{1}{4}$	37 $\frac{1}{2}$	-0 $\frac{1}{2}$	+2 $\frac{1}{4}$	{ Dark and cloudy all day; wind brisk at S.W.; air moist; evening foggy; bar. 29.8.
4 $\frac{1}{2}$	-1 $\frac{1}{4}$	-2 $\frac{3}{4}$	43 $\frac{3}{4}$	42	41 $\frac{1}{4}$	+1 $\frac{3}{4}$	+2 $\frac{1}{2}$	{ Morning rainy; clear at noon; cloudy late in the evening; wind at N.; bar. 29.6.
—	-1	—	36	35 $\frac{1}{4}$	—	+0 $\frac{3}{4}$	—	{ Morning cloudy; wet mist; wind brisk at E.; towards evening rain mixed with snow; night clear; bar. 29.2.
8	—	-1 $\frac{1}{2}$	33 $\frac{1}{2}$	34	36	-0 $\frac{1}{2}$	-2 $\frac{1}{2}$	{ Morning foggy; a little snow about noon; evening clear in the zenith; little wind at N.; bar. 28.9.
8	-1 $\frac{1}{2}$	-3	36	34 $\frac{3}{4}$	35 $\frac{1}{2}$	+1 $\frac{1}{4}$	-0 $\frac{1}{2}$	{ Morning clear; cloudy at noon; little snow in the evening; moderate breeze of wind at N.E.; bar. 29.3.
9 $\frac{1}{2}$	+1	+0 $\frac{1}{2}$	31 $\frac{1}{4}$	30	33 $\frac{1}{2}$	+1 $\frac{1}{4}$	-2 $\frac{1}{4}$	{ Morning dark and cloudy; wind very brisk at N.E.; air dry, and felt very cold; bar. 29.3.
2	-0 $\frac{1}{2}$	-1	24 $\frac{1}{2}$	24 $\frac{3}{4}$	—	-0 $\frac{1}{4}$	—	{ Morning hazy; dry misty air; wind very cold and brisk at S.E. by E.; bar. 29.7.
6 $\frac{1}{2}$	+0 $\frac{1}{2}$	-1	22	21 $\frac{1}{2}$	21 $\frac{1}{2}$	+0 $\frac{1}{2}$	+0 $\frac{1}{2}$	{ Morning clear in the zenith; dry misty fog below; wind very cold and brisk at S.E. bar. 29.7.
3	+0 $\frac{1}{2}$	-0 $\frac{3}{4}$	21 $\frac{1}{2}$	—	21 $\frac{1}{2}$	—	—	{ Sometimes clear, sometimes cloudy; wind brisk at S.E.; evening rain with snow; wind S. very high in the night; bar. 29.4.
0	—	—	34	—	33 $\frac{1}{2}$	—	+0 $\frac{1}{2}$	{ Wet mist all day; wind moderate at W.; bar. 29.4.
2 $\frac{1}{2}$	+0 $\frac{1}{2}$	—	40	39 $\frac{1}{2}$	40	+0 $\frac{1}{2}$	—	{ Morning thick fog and misty rain; wind S.E.; afternoon and evening very high at S.W. with rain; bar. 29.6.
6	+0 $\frac{3}{4}$	—	45 $\frac{1}{2}$	45	45 $\frac{1}{2}$	+0 $\frac{1}{2}$	—	{ Morning rainy; wind S.W. by W.; clear at noon; afternoon and evening very clear and still; wind S.W.; bar. 29.6.
7 $\frac{3}{4}$	-3 $\frac{1}{4}$	-5 $\frac{1}{4}$	46 $\frac{1}{2}$	44 $\frac{3}{4}$	45 $\frac{1}{2}$	+1 $\frac{3}{4}$	+1	{ Morning misty rain; wind high at S.; even- ing very clear and still; bar. 29.8.
1	-3	-4 $\frac{1}{4}$	36 $\frac{1}{2}$	35 $\frac{1}{2}$	—	+1	—	{ Morning very clear; little wind at N.E. even- ing very clear and still; bar. 30.1.
7 $\frac{1}{2}$	-4 $\frac{1}{2}$	-6	31	30 $\frac{3}{4}$	—	+0 $\frac{1}{4}$	—	{ Morning very clear; moderate breeze of wind at S.E.; evening very clear and still; bar. 30.2.
0 $\frac{1}{2}$	-3	-4 $\frac{1}{2}$	29	27 $\frac{1}{2}$	27 $\frac{1}{2}$	+1 $\frac{1}{2}$	+1 $\frac{1}{2}$	{ Morning very clear; cloudy about noon; evening dark and cloudy; little wind at S.E.; bar. 30.0.
5 $\frac{1}{2}$	+0 $\frac{1}{2}$	+0 $\frac{1}{2}$	32	32	31 $\frac{1}{2}$	—	+0 $\frac{1}{2}$	{ Morning dark and close; very dark all day; wind W.N.W.; bar. 29.8.

